

REMARKS

Reconsideration of the above-identified patent application, as amended, is respectfully requested. The present amendment is responsive to the Office Action mailed November 4, 2002.

By the present amendment, claims 12 to 21 are pending in the application.

Support For Claims

New independent claim 12 is based upon original independent claim 1. Additional limitations in new independent claim 12 are supported as follows. The passivation film on the surface of the separator and destroying the passivation film are disclosed in the specification, e.g., at page 4, lines 22-33. The separator being made of a metallic material is disclosed in the specification, e.g., at page 8, lines 22-24 and lines 34-36. The recited carbon contact resistance appeared in original dependent claim 11.

New dependent claims 13-21 are based upon original dependent claims 2-10.

The hardness 400-2000 Hv in new dependent claim 19 appeared in original dependent claim 7.

New matter is not being presented by the present amendment.

§112, ¶2

The claims were rejected under 35 U.S.C. §112, second paragraph, as being indefinite.

By the present amendment, original claims 1-11 have been canceled and replaced with new claims 12-21.

In new dependent claim 19, corresponding to original dependent claim 8, the term "hard" as describing "metal" has been replaced by "hardness of 400-2000 Hv".

In new claims 12-21 the terms "high" and "low" have been deleted.

It is respectfully requested that the rejection under 35 U.S.C. §112, second paragraph, as applied to new claims 12-21, be withdrawn.

§103

Claims 1, 2 and 7-11 were rejected under 35 U.S.C. §103(a) as being unpatentable over Applicants' admitted state of the art (specification pp. 1-2) in combination with U.S. Patent No. 6,015,586 to Omori et al.

Claims 3, 5 and 6 were rejected under 35 U.S.C. §103(a) as being unpatentable over Applicants' admitted state of the art (specification pp. 1-2) in combination with Omori et al. and further combination with EP-911425A1.

Claim 4 was rejected under 35 U.S.C. §103(a) as being unpatentable over Applicants' admitted state of the art (specification pp. 1-2) in combination with Omori et al., and further combination with EP-911425A1, U.S. Patent No. 5,516,586 to Singer et al., or U.S. Patent No. 3,754,976 to Babecki et al.

These rejections, as applied to new claims 12-21, are respectfully traversed.

Patentability

A metal separator for a fuel cell must have a surface having a high corrosion resistance and a low contact resistance against a neighboring carbon material, these two surface properties frequently conflicting with each other.

From this viewpoint, the applicants' admitted prior art Japanese Unexamined Patent Publication (Kokai) No. 10-228914 primarily proposed a metal separator using gold plating, in which a stainless steel is gold plated so that the conflicting surface properties of the high corrosion resistance and the low contact resistance are simultaneously provided by the plated gold. Thus, this prior art publication was of a significant value because it first showed the feasibility of a metal separator for a fuel cell.

However, to produce such a gold-plated stainless steel, the only known production processes were those such as a wet plating process disclosed in the above-recited prior art publication that requires a number of process steps or PVD and CVD processes that require a large scale plant. Therefore, further reduction in the production costs and further improvement in the production process therefor are necessary to enable these processes to be practically usable.

To provide a solution for this problem, the present inventive process uses a separator base made of metallic material exhibiting corrosion resistance when imparted with a passivation film thereon such as stainless

steels, aluminum, aluminum alloys, titanium, titanium alloys and projects to the separator base a solid plating material comprised of core particles having a higher hardness than the separator base and coated with a metal having corrosion resistance and a specified carbon contact resistance. The corrosion resistant metal is deposited on and uniformly dispersed over the separator base while partially destroying the passivation film that causes a high contact resistance, thereby forming electrical conducting islands of the corrosion resistant metal providing electrical connection between the separator base and a carbon paper, which advantageously realizes the reduction of contact resistance through a high speed process. See, e.g., the specification, particularly page 4, lines 18 to 32.

USP 6,015,586 only discloses improved corrosion resistance on ordinary steel or the like obtained by coating it with a zinc alloy having a sacrificial anodic property so that the less noble coated metal elutes ions under a corrosive environment while the corresponding generated electrons maintain the potential of the steel to the minus side, thereby preventing ionization of the steel. Specifically, in US `586, particles of a metal having a sacrificial anodic property are projected to the steel surface to form a thick deposition in a short time.

The projected particles of USP `586 having a structure comprised of an iron alloy core coated with an iron zinc alloy, which initially appears to be similar to

the composite structure of the projected particles of the present invention, but is actually distinguished from that of the present invention in the following respects.

USP `586 is silent about the hardness of the projected particles including those of the core and the coating with respect to the hardness of the base material subject to the projection. USP `586, column 5, line 52 merely describes an iron alloy core having a hardness of at least 790 Hv but is silent about the reason therefor. Column 6, lines 49 to 57 describes that the hardness of the iron zinc alloy particle having an iron alloy core has a significant influence on the deposition amount on the projected surface but is silent about the relationship with the hardness of the base material as specified by the present invention, and therefore, there is no suggestion that a passivation film is destroyed to provide electrical connection.

The projected particles of the present invention advantageously destroy a passivation film on the separator base and form electrically conducting islands on the separator base to provide reduced contact resistance with a carbon material in contact therewith. Thus USP `586 relates to a technology fundamentally different from the present invention.

It should be noted that USP `586 is specifically directed to zinc alloy plating to provide the corrosion resistance based on sacrificial anodic effect, which is unacceptable for a metal separator for a fuel cell because

ions of the plated metal would cause contamination of the electrode. This also indicates that USP '586 relates to a technology fundamentally different from the present invention.

It is therefore submitted that new independent claim 12 is not disclosed or suggest by the Applicants' admitted prior art in combination with U.S. Patent No. 6,015,586 to Omori et al.

Therefore, new independent claim 12 is patentable.

The remaining references cited by the Office Action were only cited against the dependent claims. They do not relate to the manufacturing a fuel cell unit in accordance with the present invention.

Since independent claim 12 is patentable, new dependent claims 13 to 21, dependent on independent claim 12, are also patentable.

Drawings

Form PTO-948, Notice of Draftsperson's Patent Drawing Review, was not attached to the Office Action. Applicants respectfully request to be advised of the status of the drawings in the next communication from the Patent and Trademark Office.

CONCLUSION

It is submitted that in view of the present amendment and foregoing remarks, the application is now in condition for allowance. It is therefore respectfully requested that the application, as amended, be allowed and passed to issue.

Respectfully submitted,

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